**SIAC Activity 1.1: Testing the Effectiveness of Methodologies for Tracking the Uptake and Adoption of Improved Varieties:**

**Pilot Study: Common Beans in Zambia (in collaboration with ZARI and CIAT)**

**Research design and survey instruments**

MSU, version: July 28, 2013

**Objective:**

To pilot test and validate alternate approaches to collect variety-specific adoption data against a reliable benchmark to determine which method/approach is the most cost-effective (i.e., which method provides a given level of accuracy at the least cost). The idea is to come up with ‘lessons learned’ and recommendations on methods / approaches that can be used in scaling up the collection and assembly of diffusion data on improved varieties.

**Methodology:**

Testing and validating alternate approaches to collect variety-specific adoption data requires two things:

1. Defining alternate approaches to collect variety-specific adoption data; and
2. Defining a ‘reliable benchmark’ against which the alternate approaches will be evaluated.

*Defining alternate approaches:*

This study will test the effectiveness of the following four **household-based methods** of tracking varietal adoption for common beans.

* Method A: Elicitation from farmers by asking him/her some basic questions for each variety planted
* Method B: Showing the farmer seed samples representing different varieties and asking him/her to identify the sample that matches each of the variety grown on their farm.
* Method C: Collecting seed samples representing each variety planted by farmers for latter identification by experts (i.e., breeders)
* Method D: Enumerator taking photos of the seeds during the survey for latter identification by experts (i.e., breeders)

*Defining reliable benchmark:*

The accuracy of adoption estimates derived from the above four methods will be evaluated against the varietal identification established through ‘DNA fingerprinting’ of seed samples collected from the farmers (under Method C). This will involve the following steps.

Step 1: Establish a panel or library of DNA fingerprints

* 1. Identify a list of improved bean varieties currently in use in Zambia– Use the Zambia Agricultural Research Institute (ZARI) “Zambia Bean Varieties Descriptor” booklet as a starting point. This booklet lists and provides varietal descriptors for 10 varieties (see Table 1). We could add more varieties (local or improved) if bean experts consider that more varieties are currently grown in the country.[[1]](#footnote-1)
  2. If CIAT does not have materials/samples to develop the library, we need to request materials/samples for each of the varieties to be included in the ‘sequencing library’ from the bean-breeding program at ZARI (i.e., from Dr. Mui Mui) and ship them to our collaborator for seed germination and DNA extraction.[[2]](#footnote-2)
  3. Do the lab analysis to establish a panel or library of DNA fingerprints[[3]](#footnote-3) for all the released improved (and selected popular local) bean varieties

Step 2: Collect the samples (seeds) for DNA fingerprinting corresponding to each data points where household-based variety-specific adoption information based on alternate methods (A-D) will be collected. This will be done by collaborating with ZARI on the planned (PABRA funded) adoption survey in northern Zambia.

**Table 1: Summary of improved bean varieties released in Zambia**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variety name** | **Year of release** | **Seed color** | **Seed size** | **Growing Habit** | **Color of flowers** | **Color of immature pods** | **Color of mature pods (before drying)** |
| Kalambo | 2011 | Cream mottled | Large | Indeterminate Dwarf | White | Green with speckles | Cream with speckles |
| Chambeshi | 1998 | Khaki / cream | Large | Bush | White | Green | Cream |
| Lukupa | 1999 | Cream mottled | Medium | Indeterminate bush | White | Green | Cream with stripes |
| Lyambai | 1999 | Red mottled | Medium | Bush | Pinkish | Green | Cream |
| Kalungu | 2004 | White | Medium | Indeterminate bush | White | Green | Cream |
| Kabulangeti | 2007 | Purple | Medium | Indeterminate (semi-climber) | White | Green | Cream with purplish stripes |
| Kapisha | 2007 | Cream | Medium | Indeterminate (semi-climber) | White | Green | Cream |
| Kabale | 2007 | Pinkish | Medium | Bush | Pinkish | Green | Cream |
| Lwangeni | 2009 | White | Small | Indeterminate bush | White | Green | Cream |
| Sadzu | 2011 | Red mottled | Large | Climber | White | Green | Cream |

*Source: ZARI, 2011. Zambia Bean Varieties Descriptor. 16 p.*

**Research Design**

Seed samples and data corresponding to the four methods will be collected from all the 402 households to be surveyed under the PABRA study on bean varietal adoption and impact survey. This survey will take place in 3 districts in Muchinga Province and 4 districts in the Northern Province. Six farmers will be randomly selected from 67 villages across 7 districts in these two provinces. Below we describe each of the Methods to be used for data collection as part of the PABRA survey. The questionnaire corresponding to the two elicitation methods (A and B) is included in Annex 1.

**METHOD A: Elicitation from the farmer**

**This Method consists of:**

1. **Implementing Section X, questions X1 – X10.**

This Section collects information from the farmer on bean varieties he/she planted across all the fields during the last season.

**METHOD B: Identification of varieties by farmers based on seed samples**

**This Method consists of:**

1. **Implementing Section Y**

This Section requires showing seed samples of all the released varieties (plus some popular local varieties) (organized in small pockets of plastic bag or small jars that are easy to carry) and asking the farmer whether the variety he/she is growing matches any of the variety in this sample. The seed samples will be labeled with codes so as to not influence farmer response by the name of the variety. The idea is to see if farmers are able to visually identify the varieties they are growing.

**METHOD C: Identification of varieties by experts (i.e., breeders) based on seed samples collected from farmers**

**This Method consists of:**

1. **Collecting seed samples of varieties grown by the farmer for later identification by breeders or other bean experts.**

This method is an extension of the step involved in doing the DNA fingerprinting analysis for varietal identification. The seed samples to be collected for that purpose will be also used to seek expert elicitation on varietal identification.

The protocol for seed sample collection will include:

1. At the end of the interview, asking the farmer if s/he can show seeds of each of the varieties they grew and that were listed in Section X
2. Collecting 10-15 seeds from each variety (exact protocol for seed selection to be developed)
3. Storing each collected sample with appropriate identifier information in a plastic or a paper bag or small envelope for storage
4. Seeking expert elicitation on collected samples before the seeds undergo DNA extraction and analysis (protocol to be developed)

**METHOD D: Identification of varieties by experts (i.e., breeders) based on photographs**

**This Method consists of:**

1. **Taking photographs of the bean seeds in the field.**

The enumerator will take photographs of the seeds selected for Method C. A protocol to record and identify each photo with the correct farmer, field and variety data point will be developed.

1. **Consultation with bean experts/breeders to identify bean varieties.**

An expert elicitation meeting will be convened after the end of the survey to seek their opinion on varietal identification based only on the photographs.

**ANNEX 1: Survey instruments to test Method A and B**

**PART X: BEAN VARIETIES PLANTED ACROSS ALL FIELDS DURING THE LAST SEASON (December 2012 - April 2013)**

**X1. *Enumerator:*** *Please note the time you start this module (hh:mm)* ***X1.1\_\_\_\_\_\_\_: X1.2\_\_\_\_\_\_\_***

***Enumerator, please read the following to the farmer*:** Now I would like to ask you about the bean varieties your household grew on the fields reported in **PART E**.

***Enumerator:*** *Please use one row for each bean variety the farmer grew this last season and start with the variety that occupied the largest area. The number of rows to be filled should equal the answer in X2.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X2** | **X3** | **X4** | **X5** | **X6** | **X7** | **X8** | **X9.1** | **X9.2** |
| How many **bean varieties** did you grow **on your farm** in the season that just ended? | Variety ID  *(The number of rows for the remaining questions should match the number in X2)* | Name of the Variety  *(As reported by the farmer. Names should match with varieties identified in E11.1-E11.3 across all the fields)*  *(****Write legibly*** *for post-coding)*  [97] Don’t know | Is this variety a local or an improved variety?  [1] Local  [2] Improved  [97] Don’t know | Year when you first planted this variety on your farm  YYYY  [9999] = More than 10 years ago, but don’t remember the exact year | Primary source of the seed used in the first season when you acquired the seed and in the last season  [1] Saved from own harvest  [2] Purchased from the market  [3] Purchased from other farmers  [4] Provided free by other farmers  [5] From NGOs /government  [6] From a research institute  [97] Don’t remember/ Don’t know  [99] Other (specify): | | When was the last time you acquired (from outside your farm) the seed of this variety for use on your farm?  *Year prior to 2013 (YYYY)*  [0] Acquired in the last season  [88] More than 10 years ago  [89] I never acquired seed | Was this seed that you last acquired from outside your farm -- certified seed, local seed grower or grain?  [1] Certified seed (chemical dressed)  [2] Quality declared seed (from local seed growers)  [3] Grain from fellow farmer  [4] Grain from market  [97] Don’t know  [99] Other (specify) |
| First season | Last season |
|  | **V1** |  |  |  |  |  |  |  |
|  | **V2** |  |  |  |  |  |  |  |
| **V3** |  |  |  |  |  |  |  |
| **V4** |  |  |  |  |  |  |  |
| **V5** |  |  |  |  |  |  |  |
| **V6** |  |  |  |  |  |  |  |

***X10: Enumerator:*** *Please note the time before continuing this module (hh:mm)* ***X10.1\_\_\_\_\_\_\_: X10.2\_\_\_\_\_\_\_***

**PART Y: IDENTIFICATION OF BEAN VARIETIES BY THE FARMER BASED ON SEED SAMPLES**

***Y1: Enumerator:*** *Please note the time you* ***start*** *this module (hh:mm)* ***Y1.1\_\_\_\_\_:Y1.2\_\_\_\_\_***

***Enumerator:*** *please copy the same information for X4 from Section X (in the same order). When showing the seed samples, write down the code number on the selected picture, not the characteristic itself.*

|  |  |  |
| --- | --- | --- |
| **X3** | **X4** | **Y2** |
| Variety ID | Name of the Variety planted on your farm (as reported by the farmer)  *(****Copy from Section X in the same order as was listed in X4****)* | Please tell me which of the following seed samples best match <*the variety*> that you grew this last season on your farm?  ***Show seed samples and record the sample number in the row corresponding to the variety***  [97] Does not match with any seed sample |
|
| **V1** |  |  |
| **V2** |  |  |
| **V3** |  |  |
| **V4** |  |  |
| **V5** |  |  |

**Y3. *Enumerator:*** *Please note the time you* ***finish*** *this module (hh:mm)* ***Y3.1\_\_\_\_\_:Y3.2\_\_\_\_\_***

1. If the GBS technique is used for this step, the library could include popular local varieties since the cost of doing DNA analysis is based on a plate that consists of 95 wells (i.e., samples). [↑](#footnote-ref-1)
2. Dr. Mui Mui’s program at ZARI has offered to to germinate the seeds for DNA extraction. But they don’t have the capacity to do the DNA extractions in the lab. We are thus looking for guidance / technical input from CIAT researchers on how to execute this step. [↑](#footnote-ref-2)
3. We are referring this output as ‘DNA fingerprints’. However, we have learned that there are two different techniques that can potentially be used – SNPs or GBS, each with varying costs and different types of data outputs. Again, we would welcome technical guidance from CIAT on the appropriate technique to use to achieve the objective of this study. [↑](#footnote-ref-3)